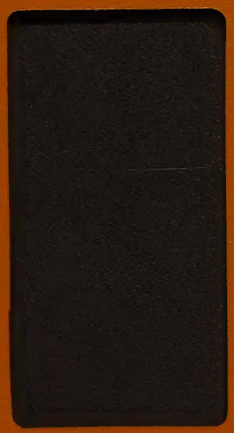
SYSTRON DONNER



INSTRUCTION MANUAL

This manual describes the RS Series Constant Voltage/Constant Current Power Supplies. It contains information on the following:

Model RS20-20B OV
Model RS40-15B OV
Model RS60-12B OV
Model RS160-4B OV
Model RS320-2C

RS SERIES
CONSTANT VOLTAGE/CONSTANT
CURRENT POWER SUPPLIES

MODEL NO. RS40-15B OV

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SYSTRON DONNER CORPORATION

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FSCM No. 52542

SYSTRON DONNER
CORPORATION

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Every Systron-Donner power supply carries a five year warranty. The company warrants each standard power supply of its manufacture to be free from defects in material and workmanship. Our obligation under this warranty is limited to making good at our factory any part or parts including semiconductors, which shall, within five years after delivery to the original purchases, be returned to us with transportation charges prepaid; and to labor incident to servicing or adjusting any instrument returned to our factory, within a period of two years after delivery to the original purchaser; provided that our examination shall disclose to our satisfaction a basic defect in material or workmanship. Warranty returns must be authorized in advance, by the factory. We reserve the right to made changes in the design of our equipment without incurring any obligation with respect to equipment previously produced. This warranty is in lieu of all other obligations or liabilities expressed or implied, and specifically excludes all liability for consequential damages and costs.

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Please specify both model and serial number in all correcpondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest service representative; or, Service Manager, Service Division, Systron-Donner Corporation, 935 Detroit Avenue, Concord, California 94518.

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SECTION 1
DESCRIPTION

1.1 INTRODUCTION

The RS Series power supply is a flexible and dependable source of DC power which can be used to meet a variety of needs ranging in scope from inspection and production testing, to laboratory bench testing and systems applications.

The wide range of outputs available makes this unit well suited for use as a basic laboratory power source. The ability to provide power packaged in minimum space with high reliability meets the demads of most systems requirements.

This instruction manual provides general characteristics and specifications, operating procedures, theory of operation, troubleshooting, calibration, parts lists and related schematics for the RS Series Power Supply.

1.2 DESCRIPTION

The low profile RS Series units are designed for laboratory and system applications. Constant Voltage and Constant Current operation is provided with automatic crossover. Automatic Tracking Overvoltage Protection (OV) Option is a Patented automatic fail-safe overvoltage protection circuit. The OV circuit protects the load against receiving a voltage in excess of the programmed output voltage of the supply. The protection point automatically tracks the programmed output voltage.

1.3 GENERAL FEATURES

Automatic short circuit protection, remote voltage programming, remote sensing, no turn on/turn off transients, an overvoltage protection option, an all silicon design and +71°C operation are featured in the RS Series power supply. Output, Sensing, Remote Voltage Programming and Remote Current Programming terminals are located on terminal boards mounted on the rear panel of the unit. The power switch, power on indicator light, mode indicator light, current and voltage controls and appropriate metering devices are all located on the front panel. For convenience, additional output terminals have been provided on the front panel.

1.3.1 Constant Voltage Mode

A constant voltage is maintained across the output terminals at any preset value from zero to rated voltage output, provided that the load does not draw more than either the rated output current or more than the preset limiting current value determined by the front panel current control settings.

1.3.2 Constant Current Mode

Constant current operation is achieved by maintaining a constant voltage across an internal current sensing resistor. An automatic corssover network changes the mode of operation from Constant Voltage to Constant Current when the current demand reaches that of the preset current adjust control. The function of variations is load consitions. The corssover point is adjustable, and can be established anywhere within the current and voltage range of the unit.

1.3.3 Automatic Current Limiting

Short circuit protection is provided by the Automatic Current Limiting circuit which limits the maximum output current under all load conditions. The point at which automatic current limiting occurs is variable, and may be selected anywhere from 1% of the rated current to the full rated current output of the unit. In the event of a short circuit, the output voltage drops to zero, and returns to normal only when the short circuit is removed.

1.3.4 Mode Indicator

A front panel mode indicator light indicates when the unit is operating in either the constant current or current limiting mode of operation.

1.3.5 Automatic Overvoltage Protection (Optional Feature)

Automatic Overvoltage (OV) Protection is available as an option wherein special circuitry automatically tracks the programmed output voltage and prevents it from exceeding this output voltage. The voltage differential that will cause the OV to trip is approximately 5% or 1.5 volts above the programmed voltage. Minimum OV trip point is approximately 5 volts.

1.3.6 Remote Programming

Remote Programming is provided in both the voltage and current modes of operation. Both voltage and current may be remotely programmed over their entire ranges. The scale factor for Remote Voltage Programming is shown in Table 2-2. The Remote Current Programming is approximately determined by computing the value of the programming resistor using the formula below:

$$RPGM = 100 \left(1 - \frac{\text{Load Current}}{\text{Rated Current}}\right).$$

1.4 PRECAUTIONARY MEASURES

1.4.1 Wire Size

To assure proper regulation under all load conditions, and to prevent severe distortions of the AC line voltage, it is very important to take into consideration the physical size and current handling capabilities of the input power line. Seriout losses in regulation and an increase in ripple may result from under rated or over loaded AC input lines. The maximum AC impedance from the breaker box to the power supply input should not exceed 0.75 ohms. See Table 2-1 for recommended wire sizes.

1.4.2 Voltage Regulator and Inverter Inputs

Do not use voltage regulators or inverters as a primary power source. The outputs of these devides are usually not sinusoidal in nature, and if used as the AC source for the power supply, will cause serious loss of regulation of the power supply output. Capacitive input filtering used for semiconductor power supplies requires charging to the peak of the rectified AC wave which nonsinusoidal AC sources cannot provide.

1.4.3 Variable Transformer Input

If a variable transformer is to be used to test the power supply for low and high AC line operation, it must be able to supply at least twice the VA requirements of the power supply and load.

1.4.4 Systems Considerations

In systems applications it is recommended that each power supply input power line be run separately to the AC distribution box, in order to minimize cross coupling and interaction between equipment. Do not run sensitive signal leads such as the remote sensing leads in the same cable as the AC input without shielding. It is strongly recommended that the AC input cables should not be run in close proximity to the output load cable leads, if minimum ripple is desired.

1.4.5 Terminal Post Resistance

All terminals and shorting links serving Outputs, Sensing and Programming must be securely tightened before use. Serious loss of regulation and an increase in ripple can result due to a voltage drop caused by loose terminals and shorting links.

The specifications cited herein for regulation and ripple can be readily attained on every power supply providing the proper method of measurement is employed. The major consideration is that the highly stable meter and oscilloscope, specified in the calibration procedures, must be connected to the sensing terminals and not the load terminals. The reason for this precaution is that the voltage drop between the load terminals and sensing terminals will yield an inaccurate regulation ripple measurement.

1.5 SPECIFICATIONS

Table 1-1 is a complete list of standard specifications for the RS Series Power Supply.

TABLE 1-1 SPECIFICATIONS

CONSTANT VOLTAGE MODE WITH ADJUSTABLE CURRENT LIMITING	
Input:	105-125 VAC, 55-65 Hz (200-240) VAC, 50 or 400 Hz available).
Output:	Floating; isolated from ground, 300 VDC maximum.
Regulation, Line:	0.01% or 3 mV[1], for 105-125 VAC line change at any output within specifications.
Regulation, Load:	0.1% or 3 mV[1] no load to full load at any output within specifications.
Ripple:	Less than 0.5 mV RMS.

TABLE 1-1 SPECIFICATIONS (Cont'd)

CONSTANT VOLTAGE MODE WITH ADJUSTABLE CURRENT LIMITING (Cont'd)	
Stability:	0.05% or 18 mV[1] for 8 hours after warm-up. Measured at constant line voltage, load and ambient temperature.
Temperature Coefficient:	(0.2% +400 μV)/°C.
High Stability Option (X):	0.1% or 2 mV[1] with a T.C. or (0.01% +100 μV)/°C.
Temperature Range:	-20%C to +17°Ct.
Recovery Time:	25 microseconds to recover within 0.05% or 15 mV[1] of output voltages for Δ1 step change in rated load. (See table.)
Short Circuit Protection:	Automatic Adjustable Current Limiting (ACL) variable from 1% of rated current.
AC Power Input Protection:	Fuse.
Remote Programming (RVP):	All units remotely programmable over output voltage range. See Chart for RVP scale factor.
Remote Sensing:	Maintains rated regulation directly at the load. Maximum line drop 0.5 V per leg.
Voltage Adjustment Range:	Continuously adjustable 10-turn control.
Overvoltage Protection (Internal Option):	Automatic fast acting overvoltage protection tracks the preset output voltage.
CONSTANT CURRENT MODE WITH ADJUSTABLE VOLTAGE LIMITING	
Current Range:	1% to rated current output.
Voltage Compliance:	0 to rated output voltage.
Regulation, Line:	0.5% I_{rated} for 105-125 VAC line change at any output within apecifications.
Regulation, Load:	0.5% I_{rated} output current change for the maximum change in load resistance within the rated voltage compliance range.
Ripple:	0.25% or 5 mA[1].
Stability:	0.5% I_{rated} for 8 hours after warm-up. Measured at constant line voltage, load and ambient temperature.
Temperature Coeffieicnt:	0.1% I_{rated}/°C.
Remote Programming:	Fully programmable over complete current range. Programming resistance $R_{pgm} \cong 100 (1 - I_{load}/I_{rated})$.

TABLE 1-1 SPECIFICATIONS (Cont'd)

GENERAL AND PHYSICAL SPECIFICATIONS	
Design Principle:	Phase controlled pre-regulation with precision series pass regulation.
Operational Modes:	Constant Voltage with adjustable current limiting; Constant Current with adjustable voltage limiting; Automatic Crossover.
Mode Indicator:	Front panel mode indicator light indicates when supply is operating in the constant current limiting mode.
Controls	
Voltage:	10-turn front panel control; 0 to rated output.
Current:	10-turn front panel control; 1% I_{rated} to rated output.
Input Power	Front panel switch and indicator.
Metering	
Voltage:	Front panel voltmeter.
Current:	Front panel ammeter.
Terminals	
Front Panel:	Positive Output (+V); Negative Output (-V); Ground (G).
Rear Panel:	(1-2) Remote Current Programming RIP; (3) Ground G; (4-5) Remote Voltage Programming RVP; (6) Negative Sensing -S; (8) Positive Sensing +S; (9) Positive Output +V. (Rear Panel RS320 unit only: Terminals 1 through 5, same as above. Use TB3 for DC outputs -V,-S,+V,+S.)
Size:	All units 19"W x 3-1/2"H x 14-5/8"D (except TS320-2C which is 16-1/6"D).

[1]Whichever is greater.
[2]When stacked without free air circulation temperature should be limited to +60°C.

TABLE 1-1 SPECIFICATIONS (Cont'd)

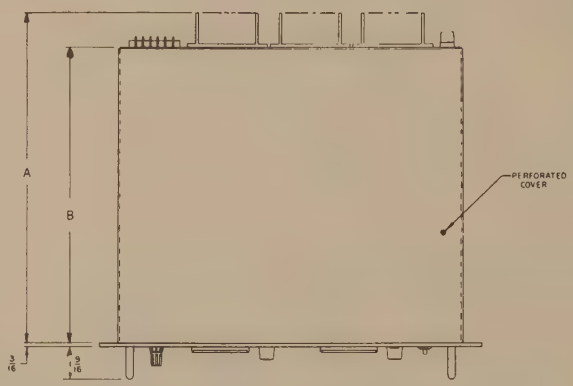
RS Series

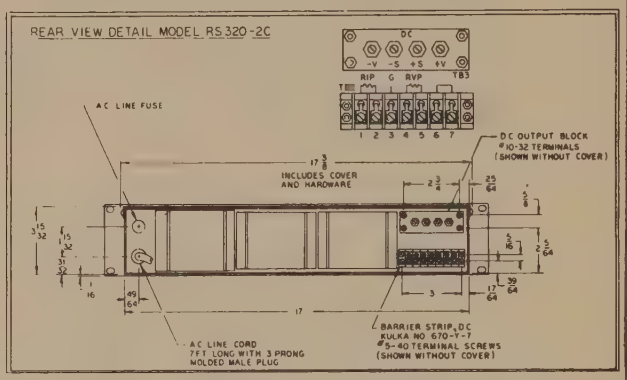
Model	Volts	Amps	40°C	60°C	71°C	RVP Scale Factor ohms/volt	ΔI	*Impedance DC-1 kHz	Weight (lbs.)	Price	OV
RS20-20B	0-20	0-20	20	13	9	100	15	0 001	47	$ 525	65
RS40-15B	0-40	0-15	15	13	9	125	10	0.002	45	525	65
RS60-12B	0-60	0-12	12	10	8	83.3	6	0.004	47	525	65
RS160-4B	0-160	0-4	4	3	2.4	312.5	1	0.005	49	645	90
RS320-2C	0-320	0-2	2	1.5	1.2	312.5	.5	0.020	49	695	—

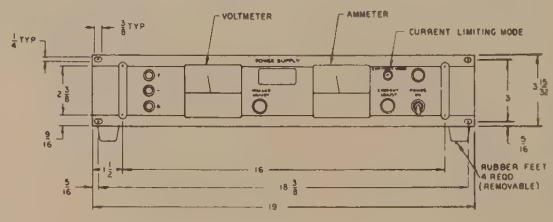
*Nominal

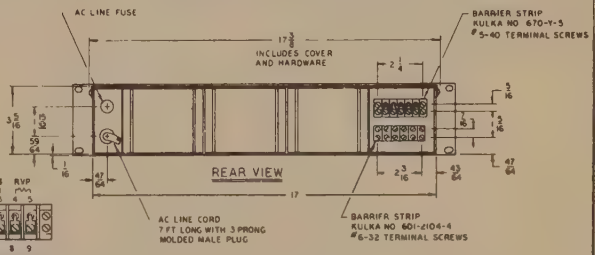
RS Series Outline Drawing

	A	B
RS	14-5/8	13
RS320-2C	16-1/16	14-5/16




REAR VIEW DETAIL MODEL RS 320-2C
DC
-V -S +S +V
RIP G RVP TB3
1 2 3 4 5 6 7
AC LINE FUSE
DC OUTPUT BLOCK #10-32 TERMINALS (SHOWN WITHOUT COVER)
INCLUDES COVER AND HARDWARE
AC LINE CORD 7 FT LONG WITH 3 PRONG MOLDED MALE PLUG
BARRIER STRIP, DC KULKA NO 670-Y-7 #5-40 TERMINAL SCREWS (SHOWN WITHOUT COVER)




AC LINE FUSE
BARRIER STRIP KULKA NO 670-Y-5 #5-40 TERMINAL SCREWS
INCLUDES COVER AND HARDWARE
REAR VIEW
AC LINE CORD 7 FT LONG WITH 3 PRONG MOLDED MALE PLUG
BARRIER STRIP KULKA NO 601-2104-4 #6-32 TERMINAL SCREWS

SECTION II - INSTALLATION & OPERATION

2.1 MECHANICAL INSTALLATION

2.1.1 Rack Mounting

Any standard EIA relay rack will accommodate the RS Series power supplies in only 3 1/2 inches of vertical mounting space. Mounting of the unit is easily accomplished by inserting four mounting screws through the slotted holes provided in the four corners of the front panel of the power supply, and on into the matching threaded holes of the relay rack.

2.1.2 Bench Use

Though designed primarily as a rack mounting unit, the RS Series power supply may be operated in a bench type configuration as well. It is therefore fully enclosed in a protective metal case, and equipped with rubber mounting feet which serve to protect the unit and the surface upon which it rests from scratching, and to provide an airflow channel under the unit for ventilation purposes.

2.2 ELECTRICAL CONNECTIONS

2.2.1 AC Input

The unit is supplied with a heavy duty 3 wire line cord equipped with molded plug and ground strap to provide a path for AC input power.

The power handling ability of the AC power lines feeding AC power to the line cord must be considered, as serious losses

2.2.1 AC Input (continued)

in regulation and substantial increases in ripple can occur as a result of insufficient power handling capacity of these lines. The AC impedance from the breaker box to the power supply input connector should not exceed 0.75 ohms. Any movable electric contact surface (such as the wiper arm of a variable transformer) should be kept clear of impedance producing oxide coatings.

Care should be exercised in selecting the proper wire size for the AC input lines. The figures listed in Table 2-1 will serve as a guide in making this selection.

TABLE 2-1 - AC INPUT WIRE SIZE

Length of Run (Single Lead)	Wire Size (AWG Standards)
10 feet or less	16
10 feet to 20 feet	14
20 feet to 50 feet	12
50 feet to 100 feet	10

2.2.2 Barrier Strips

Two barrier strips mounted on the rear panel provide output, sensing and remote programming connections. See data sheet provided following page 1-5 for outline drawing and barrier strip designations.

2.2.3 DC Output

DC output voltage is available at both front and rear panel locations, and may be sensed (monitored) either at the output terminals of the power supply (Local Sensing) or at the load itself (Remote Sensing).

2.2.4 Local Sensing

Local sensing of the output voltage may be made at the rear panel output terminals. The shorting links must be placed across rear panel terminals -V and -S and terminals +S and +V.

2.2.5 Remote Sensing

Remote sensing of the output voltage is available only if the load is connected to the rear panel output terminals. The shorting links between rear panel terminals -V and -S and terminals +S and +V must be removed, and separate sensing leads installed between sensing terminals -S and +S and the load.

2.2.6 Local Programming

Local programming of either current or voltage is available by shorting the appropriate rear panel terminals. For local current programming operation, a shorting link should be placed across barrier strip terminals 1 and 2 (RIP). For local voltage programming operation, a shorting link should be placed across barrier strip terminals 4 and 5 (RVP). In both local current programming and local voltage programming operation, the output amplitude is dependent upon the setting of the appropriate front panel adjustment control.

2.2.7 Remote Programming

Remote programming of both voltage and current may be achieved by removing the shorting link from the appropriate barrier strip terminals and substituting a remotely operated adjustment control resistance in its place.

In the remote voltage programming mode of operation, the scale factor required for the remotely operated voltage adjustment control is as shown in Table 2-2. In order for this remotely

2.2.7 Remote Programming (continued)

operated adjustment control to function properly, front panel VOLTAGE ADJUST control must be set fully CCW. Operation of this power supply without either shorting link or remotely operated adjustment control connected across remote voltage programming barrier strip terminals 4 and 5 (RVP), will result in an unregulated output voltage.

The required size of the remote current programming resistor may be determined by use of the formula Rpgm = 100 $(1 - \frac{\text{Load Current}}{\text{Rated Current}})$, where Rpgm is the remote program resistor, load current refers to the desired output current, and rated current refers to the maximum output current of the unit. To pbtain proper operation of the remotely controlled current adjust control, it is necessary that front panel CURRENT ADJUST control be set fully CW. Operation of this power supply without either shorting link or remotely adjusted current programming control connected across remote current programming barrier strip terminals 1 and 2 (RIP) will result in a complete loss of output current.

2.2.8 Shorting Links

The unit is shipped with shorting links in place across terminals 1 and 2, 4 and 5, -S and -V, and +S and +V of the barrier strips. In this configuration, local programming and sensing is available at the barrier strip terminals. Table 2-3 lists the various shorting link connections and their functions.

TABLE 2-2 - REMOTE VOLTAGE PROGRAMMING FACTORS

Model	Voltage Range	RVP SCALE FACTOR Ohms/Volt
RS20-20B	0-20V	100
RS40-15B	0-40V	125
RS60-12B	0-60V	83.3
RS160-4B	0-160V	312.5
RS320-2C	0-320V	312.5

TABLE 2-3 - SHORTING LINK APPLICATION

Terminals	Condition	Function
-S and -V +S and +V	Shorted	Local sensing and regulation at rear panel output terminals
-S and -V +S and +V	Ext. Sense Leads	Remote sensing and regulation at load
4 and 5	Shorted	Voltage programmed locally, output dependent upon voltage adjust pots
4 and 5	Ext. PGM res.	Voltage programmed remotely, output dependent upon size of PGM resistor
1 and 2	Shorted	Current programmed locally, output dependent upon current adjust pots.
1 and 2	Ext. PGM res.	Current programmed remotely, output dependent upon size of PGM resistor.

2.3 CONTROLS

2.3.1 Front Panel

TABLE 2-4 - FRONT PANEL CONTROLS

Symbol	Name	Function
S1	AC POWER	Power switch, controls input power
R66 (R56 on 'C' Version)	VOLTAGE ADJUST	10 Turn Potentiometer, adjusts voltage output
R12 (R77 on 'C' Version)	CURRENT ADJUST	10 Turn Potentiometer, adjusts current

2.3.2 Internal

All internal control settings have been factory pre-set, and require no additional adjusting. However, if it should become necessary to adjust any of the internal controls due to circuit changes caused by component aging or replacement, refer to the calibration section of this instruction manual.

2.4 OPERATION

2.4.1 Control Settings

Set all front panel controls fully CW so that unit will operate in the Voltage rather than Current Limiting mode.

2.4.2 Shorting Links

If Local Sensing rather than Remote Sensing operation is desired, ascertain that shorting links are in place across the appropriate terminals.

2.4.3 Grounding

Either side of the Output may be grounded, or the Output

2.4.3 Grounding (continued)

may be used in a floating condition.

2.4.4 Power On

Connect the power supply to a suitable source of 115 VAC, 60 cycle power. Set POWER switch S1 to AC-ON, and observe that pilot lamp DS1 glows.

2.4.5 Warm-Up

No warm-up time is necessary to place the unit into operation. However, a 30 minute warm-up period is recommended to reach rated stability.

2.4.6 Series Operation

To operate two or more power supplies in a series configuration, connect the output of each power supply in series. When operating in this mode, it is necessary to adjust the output of each unit independently. The output voltage is equal to the sum of the voltage settings of each power supply.

2.4.7 Parallel Operation

A) With rated resistive load connected across the output of power supply A as shown in Figure 2-2A, set VOLTAGE ADJUST control to desired output voltage, and set CURRENT ADJUST control for maximum rated output current.

B) Connect power supply B as shown in Figure 2-2B. With no load across the output, set VOLTAGE ADJUST control for an output voltage 2 volts higher than the output voltage of power supply A. Place a short across the output terminals, and set the CURRENT ADJUST control for 1/2 the total load current requirement.

C) Remove all former output loads and connect the outputs of power supplies A and B in parallel with each other, and

2.4.7 Parallel Operation (continued)

in parallel with the load, as shown in Figure 2-3.

D) If parallel operation of these two power supplies is desired for a systems application, it is important that both units be turned on simultaneously. It is therefore recommended that both power supplies be connected to a single large circuit breaker. Maximum output current will be twice that of either of the two power supplies, while minimum output current will be that of power supply B, or half the total load current.

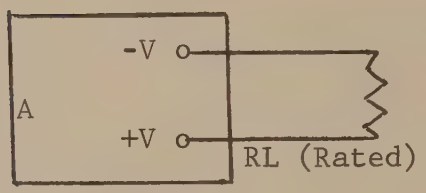


FIGURE 2-2A

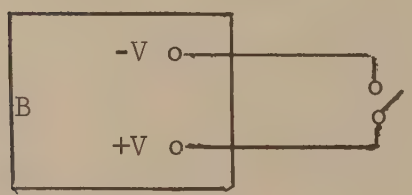


FIGURE 2-2B

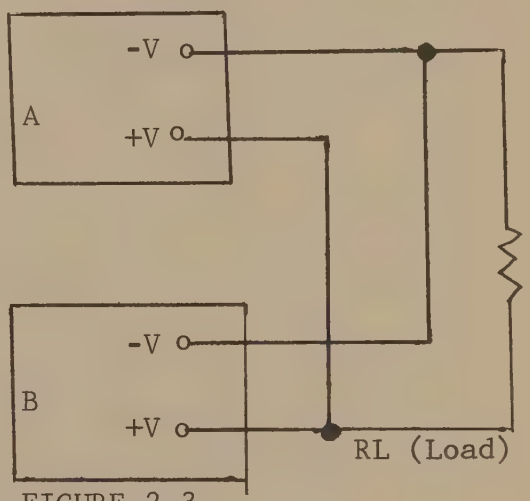


FIGURE 2-3

NOTE: If parallel operation of Trygon power supplies utilizing Overvoltage (OV) Protection is desired, consult the factory for special instructions.

SECTION III - THEORY OF OPERATION

3.1 GENERAL - (Note that circuit references applicable to the RS320- 2C are shown in parenthesis if different than the lower voltage models.)

The purpose of the RS Series power supplies is to transform and rectify the AC input into a well-regulated, stable and adjustable DC output. The following paragraphs describe the major circuits used in the power supplies. As each circuit is described, reference should be made to both the Block Diagram, Figure 3-1 and the Schematic Diagram in the rear of this manual.

3.1.1 Primary Input

Input power is obtained through power transformer T1 (T1, T2) and full wave silicon diode rectifiers. Each pair of rectifiers provide the necessary DC voltages to the various sections of the unit.

When AC power switch S1 is set to AC-ON, AC pilot lamp DS1 glows, and AC power is applied to the power transformers. Regulated DC output power is immediately available from the power supply.

3.1.2 Reference Supply

The recitified and filtered voltage from rectifiers CR1 and CR2 and filter capacitor C1 is pre-regulated by Coarse Reference Regulator zener CR13 (CR3). This provides a stabilized DC voltage to Constant Current Source Q2, whose output is regulated by Precision Voltage Reference zener CR14 (CR4). Constant Current Source Q1 controls the drive to Q2 and in turn is controlled

3.1.2 Reference Supply (continued)

by Q2. The voltages developed across Constant Current Source References CR14 (CR4) and CR15 (CR16) are highly stable reference voltages established at a higher positive potential than the positive output of the main supply.

3.1.3 Pre-Regulator

The purpose of the Pre-Regulator section is to maintain the unregulated input voltage on Input Filter Capacitor C8 (C22) at a suitable value compared to the output voltage in order to control the power dissipated the Series Regulator.

The method used to accomplish this is to "fire" a pair of SCR's (silicon controlled rectifiers), CR9 (CR27) and CR10 (CR28) at controlled points along the input sine wave to increase or decrease the potential to which the input filter capacitor may charge. The SCR's are "fired" (allowed to pass current) by the application of a positive pulse at the junction of gating resistors R35 (R57) and R37 (R58) from amplifier Q25 (Q11), which amplifies the triggering pulse from unijunction transistor Q12 (Q13). The unijunction transistor triggers the SCR's when charged sufficiently by timing capacitor C13 (C10) to cause conduction. The SCR's are turned off with each alternate half cycle of the input sine wave.

3.1.4 Series Regulator

The pre-regulated DC voltage from the SCR's is directed through the Series Pass transistors. The conduction of these transistors is controlled by circuitry which causes them to act as variable resistors. Their overall resistance varies in accordance with the need of the power supply to increase or decrease its output voltage or current.

3.1.4 Series Regulator (continued)

The Series Pass transistors are controlled by several driver stages which amplify signals from the error amplifier.

3.1.5 Comparator and Error Amplifier

The voltage sensing and comparison is accomplished by differential amplifiers Q10 (Q9) and Q11 (Q10). A sample of the output voltage on the base of Q11 (Q10) is compared to the stable reference voltage on the base of comparator Q10 (Q9). An unbalance caused by a change in voltage adjustment control R66 (R56) will appear as a voltage change in the collector of Q11 (Q10).

This difference voltage is amplified by error amplifier Q7, (Q6) and is used to regulate the Series Pass transistors via the Series Pass drivers. Error amplifier Q7 (Q6) has two diode inputs to its base which form an OR gate for error signals. CR19 (CR7) supplies error signals from the comparator, and CR18 (CR6) supplies an error signal in the event of a short circuit, or if the power supply is driven into the current limiting mode of operation.

When operating in the current limiting mode, differential amplifier Q3 and Q4 become balanced, causing diode CR18 (CR6) to conduct, and in turn drives error amplifier Q7 (Q6) toward cut-off. This signal also causes Q8 (Q7) to conduct, thereby causing current mode indicator lamp DS2 to glow.

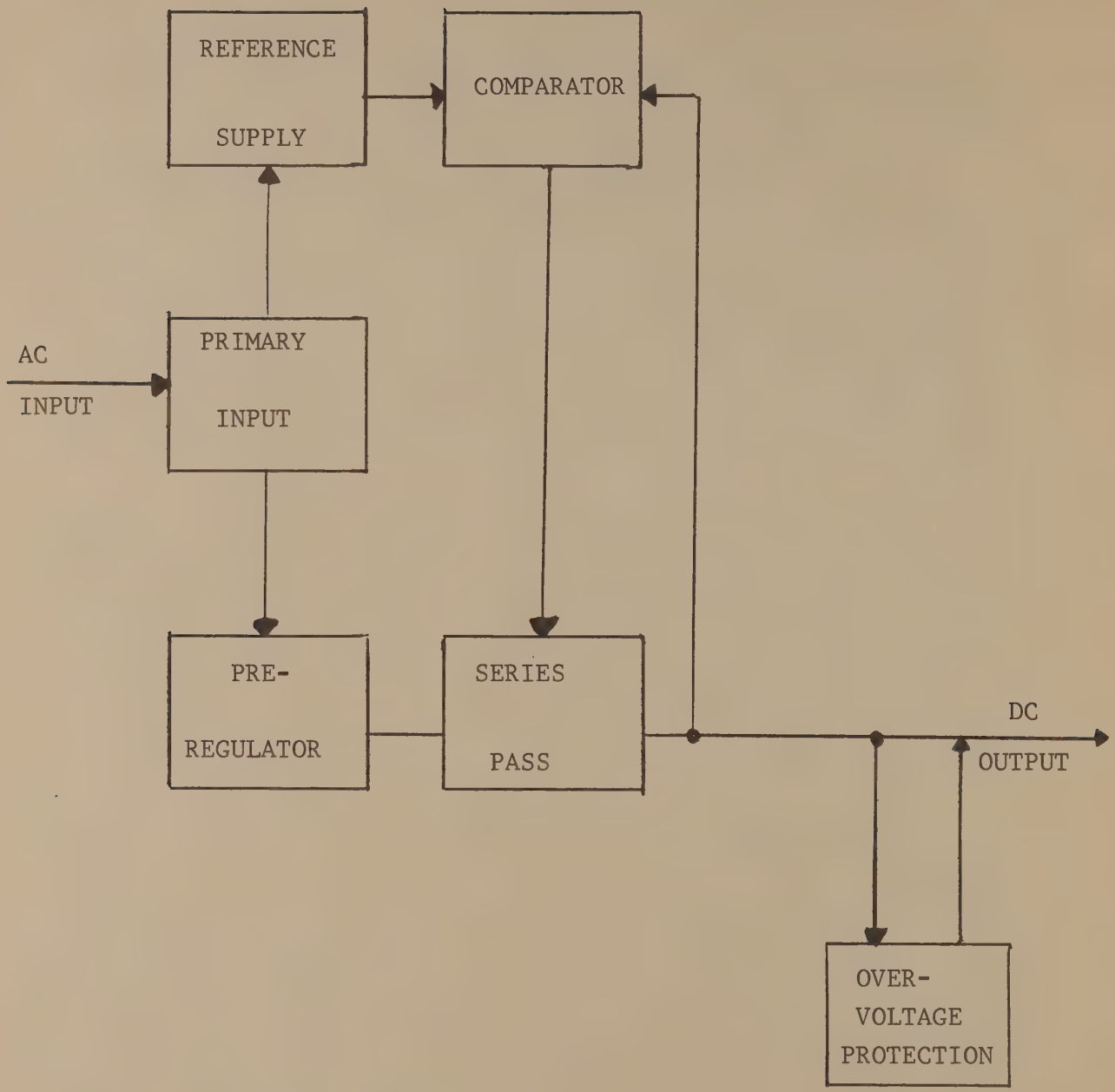


FIGURE 3-1 - BLOCK DIAGRAM

SECTION IV - MAINTENANCE

- WARNING -

HIGH VOLTAGES ARE PRESENT
USE CAUTION

4.1 GENERAL

This power supply is a precision instrument. It is strongly recommended that only experienced troubleshooting personnel perform troubleshooting operations or attempt to repair the unit. If the power supply appears to be malfunctioning at all, the following procedure is recommended for isolating possible defects.

4.2 LOADS AND INTERCONNECTIONS

1) Disconnect all loads and interconnections.

2) Connect a resistive load across the output terminals, and operate the unit to determine whether the fault lies within the unit or extermally. Observe that shorting links are in place across terminals 1 and 2, 4 and 5, -V and -S and +V and +S, and that all connections are tightly made.

4.3 TROUBLESHOOTING

1) Set the VOLTAGE ADJUST controls fully CW. Use a 20,000 ohms per volt voltmeter or digital voltmeter to check the schematic located in the rear of the manual. Any reading which is grossly incorrect indicates that the stage being tested or the one immediately preceding it, is defective. The Block Diagram, Schematic Diagram and appropriate sections of the Theory of Operation will prove helpful in any troubleshooting work. Proper

polarity to be observed when testing can be easily obtained from the Schematic Diagram.

2) If voltage checks show no deviations from the prescribed values, disconnect AC power and proceed with point to point resistance checks across pots, switches, diodes, resistors, transistors, in that order.

3) When the trouble is of an intermittent nature such as poor regulation, ripple, etc., the use of an oscilloscope to determine dynamic changes will be necessary.

SECTION IV - CALIBRATION

5.1 GENERAL

The following adjustments should be made when necessary to assure optimum operating characteristics and maximum efficiency of the power supply.

5.2 TEST EQUIPMENT REQUIRED (or equivalent)

A) Oscilloscope, Tektronix Type 561

B) Differential Amplifier Plug In, Tektronix Type 63

C) Time Base Plub In, Tektronix Type 67

D) Digital Multimeter Systron Donner Model 7004A

E) Variable Auto transformer, Powerstat Type 3PN136

5.2.1 Shorting Link Application

For test purposes, shorting links should be connected across terminals 1 and 2, 4 and 5, -V and -S and +V and +S, to provide local sensing and local programming. To reduce pick up, shielded wire must be used for all connections between test equipment and the power supply being tested. To prevent ground loops, it is important that only one ground connection be made, as shown in Figure 5-1 and Figure 5-2. Tighten all terminal connections as securely as possible, and set all front panel controls fully CW.

5.3 CALIBRATION PROCEDURE -- (Please refer to the sentence in parenthesis on top of page 3-1.)

5.3.1 Voltage Adjust Control

A) Maximum Voltage

Set front panel VOLTAGE ADJUST control fully CW. Adjust Maximum Voltage control R67 (R24) to obtain an output voltage 0.5 VDC

5.3.1 Voltage Adjust Control (continued)

in excess of the maximum rated output voltage.

5.3.2 Current Adjust Controls

A) Maximum Current

Connect a test ammeter having a full scale current indicating capacity of 150% that of the rated current output across the output terminals of the power supply. (Set all front panel controls fully CCW). Apply power to the unit under test and slowly rotate CURRENT control fully CW. Observe that the maximum current obtainable is approximately 110% that of the maximum rated current output. If it is not possible to achieve 110% of the maximum rated current output, adjust Maximum Current control R6 (72) until that value is attained. Set AC Power Switch to OFF.

Connect a suitable load resistance across the output terminal connections. The load resistance must be able to dissipate the rated power of the unit (P = IE) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Set AC Power Switch to ON. Note the voltage indicated on the Digital Multimeter. Disconnect the resistive load from the output and observe the voltage indicated on the Digital Multimeter. The maximum change in output voltage should not exceed by more than 0.01% or 3mv (whichever is greater) that of the output voltage indicated with the load resistance applied across the output terminals.

If it is not possible to maintain the load regulation as stated in the preceding paragraph, readjust Maximum Current control R6 (R72) slightly and recheck the load regulation.

5.3.2 Current Adjust Controls (continued)

B) Minimum Current

With no load on power supply, set the VOLTAGE ADJUST control to maximum (CW) and CURRENT ADJUST control to minimum (CCW). Adjust R11 (R80) until the voltmeter indicates a collapse. Turn CURRENT ADJUST control slightly CW Voltage should come back up with only this slight rotation. If it requires too much rotation then readjust R11 (R80) again. This should put the minimum current adjust setting at approximately 1% of maximum rating.

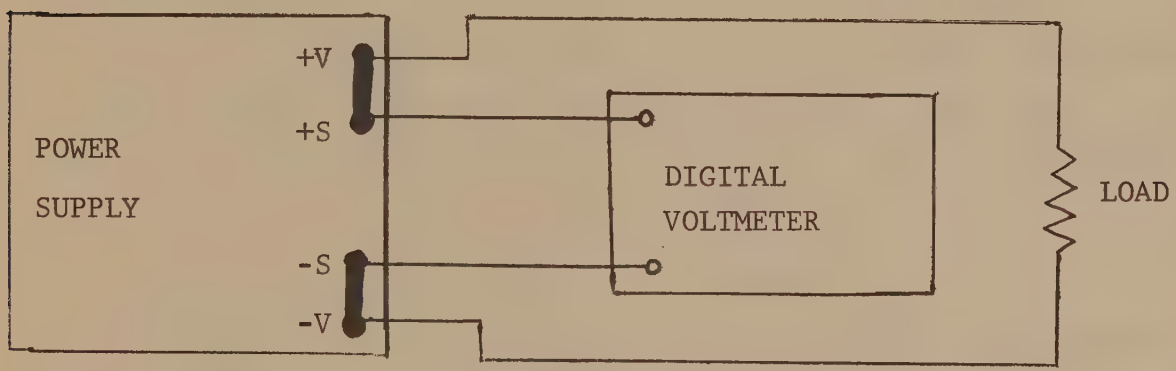


FIGURE 5 - 1

CONSTANT VOLTAGE OPERATION

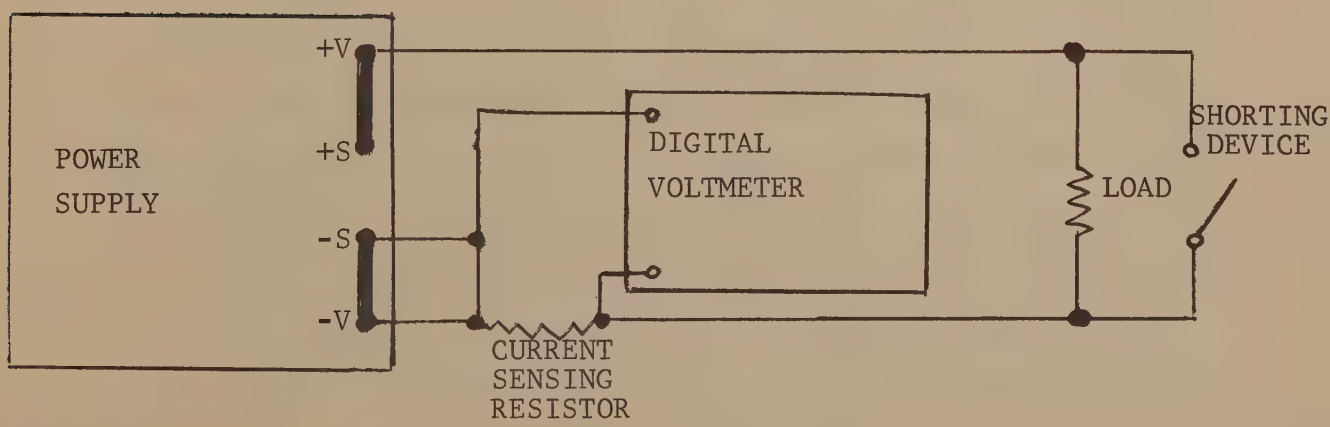


FIGURE 5 - 2

CONSTANT CURRENT OPERATION

5.3.3 Constant Voltage Operation

A) Load Regulation

With the equipment connected as shown in Figure 5-1, connect a suitable load resistance across the Output terminal connections. The load resistance selected must be able to dissipate the rated power of the unit (P = IE) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Note the voltage indicated on the Digital Multimeter. Disconnect the resistive load from the output. The maximum change in output DC voltage indicated on the Digital Multimeter should not exceed by more than 0.01% or 3mv (whichever is greater) that of the output voltage indicated with the load resistance applied across the output terminals.

B) Line Regulation

Place the resistive load across the output and note the voltage indicated on the Digital Multimeter. (Vary the input line voltage $\pm$ 10 percent. The maximum change in output voltage should not exceed by more than 0.01% or 3mv (whichever is greater) that of the output voltage measured at either extreme of the AC input.

C) Ripple Voltage

In order to reduce pickup, schielded test leads should be used in making ripple measurements. With the resistive load connected across the output terminals, measure the AC ripple with the Digital Multimeter. Vary the AC input power 10% above and below the nominal AC input level. The maximum ripple amplitude should not exceed 0.5 mv RMS.

5.3.4 Constant Current Operation

A) Load Regulation

With the equipment turned off, disconnect the resistive load from the output terminals. Connect a small current sensing resistor in series with the resistive load and then connect the load back across the output terminals. Selection of the proper value for the current sensing resistor may be easily made using the formula $RS = \frac{I}{IR}$ where RS = Value of Current Sensing Resistor and IR = Rated Load Current. Connect the equipment as shown in Figure 5-2, and apply power to the power supply.

Vary the VOLTAGE ADJUST control and resistive output load as necessary, to achieve rated current and voltage output. Decrease the load resistance until current meter reading exceeds full scale indication. Rotate CURRENT ADJUST control CCW to return the current meter reading to full scale. Observe that the output voltage has decreased from its previous full scale reading, and that increasing the VOLTAGE ADJUST control has no effect upon the output voltage or current. This indicates that the unit is now operating in the Constant Current Mode.

Measure the voltage across the small sensing resistor. Compute and note the current flow through this resistor. Change the output load from the resistive load previously used, to a short. Again measure the voltage across the small sensing resistor and compute the value of the current flow through this resistor. The change in current should not exceed by more than 0.5% the rated current previously noted with a full resistive load across the output.

5.3.4 Constant Current Operation (continued)

B) Line Regulation

Replace the resistive load across the output and measure the voltage drop across the small sensing resistor. Compute and note the current flow ($I = \frac{E}{R}$) through this resistor.

Vary the input line voltage $\pm$ 10 percent.

Note the maximum change in voltage across the senging resistor and compute the maximum current flow. The maximum change in current should not exceed by more than 0.5% the rated current previously noted at either extreme of the AC input.

C) Ripple Current

With the AC input line voltage adjusted to the nominal AC input voltage and the resistive load connected across the output, measure the amplitude of the AC ripple as seen across the sensing resistor with the Digital Multimeter. Compute and note the current flow. Vary the AC input line voltage $\pm$ 10 percent. Measure the maximum voltage drop and compute the maximum current flow. The maximum ripple current must not exceed by nore than 0.25% or 5 ma (whichever is greater) that of the current flow noted during nominal input line voltage.

ELECTRICAL PARTS LIST -- RS40-158

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
C 1	CAP 950MF-50V	00835	DRWG	82 00 51
C 2	CAP .0033MF-600V	33498	GP332K	80 00 25
C 3	CAP .001MF-200V-CK05B	33498	GP102M	80 00 06
C 4	CAP .01MF-100V-CK05B	33498	ACOM GP103P	80 00 90
C 5	CAP .047MF-400V		TYPE CM	80 01 55
C 6	CAP 34MF-15V	90201	TTXE	81 00 57
C 8	CAP 34800MF-50C	00835	DRWG	82 03 98
C 10	CAP 9300MF-50V	00835	DRWG	82 03 17
C 11	CAP 10MF-50V	90210	TTX106NO50AOLIP	81 00 10
C 12	CAP .047MF-400V		TYPE CM	80 01 55
C 13	CAP .15MF-250V		MKT1813	80 02 10
C 22	CAP .15MF-400V		CM	80 02 28
C 33	CAP 0.1MF-250V	24138	CM	80 01 85
C 34	CAP 6.8MF-6V		T360B6B6MD06AS	82 10 19
C 35	CAP 6.8MF-6V		T360B6B6MD06AS	82 10 19
C 36	CAP 250MF-20V	00853	5560H251WD15B	81 01 72
C 37	CAP .05MF-200V	33498	LTGP503M	80 01 68
C 38	CAP 75MF-15V	00835	556	81 00 90
C 39	CAP 10MF-50V	90210	TTX106NO50AOLIP	81 00 10
C 40	CAP 6.8MF-6V		T360B6B6MD06AS	82 10 19
C 41	CAP .0022MF-200V-CK05B	33498	GP222M	80 00 20
C 42	CAP .022MF-100V-CK06B	*		80 01 29
C 43	CAP 0.22MF-400V		MKT1813	80 02 54
C 45	CAP 0.1MF-100V-CK06B	56289	T6P10	80 01 76

E L E C T R I C A L P A R T S L I S T -- RS40-158

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
C 46	CAP 0.1MF-100V-CK06B	56289	TGP10	80 01 76
C 47	CAP 20MF-50V	00835	556DC200W050B	81 00 21
CR 1	DIODE 1N4004	21845	1N4004	71 03 84
CR 2	DIODE 1N4004	21845	1N4004	71 03 84
CR 3	DIODE 1N4004	21845	1N4004	71 03 84
CR 4	DIODE 1N4004	21845	1N4004	71 03 84
CR 5	DIODE 1N4004	21845	1N4004	71 03 84
CR 9	SCR C35B	83781	C35B	72 00 00
CR 10	SCR C35B	83781	C35B	72 00 00
CR 13	DIODE 1N1360A	81483	1N1360A	72 02 41
CR 14	DIODE 1N823	04713	1N823	72 04 61
CR 15	DIODE 1N2163A	24444	IN2163A	72 02 62
CR 16	DIODE 1N4004	21845	1N4004	71 03 84
CR 18	DIODE 1N4004	21845	1N4004	71 03 84
CR 19	DIODE 1N4004	21845	1N4004	71 03 84
CR 20	DIODE 1N4004	21845	1N4004	71 03 84
CR 21	DIODE 1N4004	21845	1N4004	71 03 84
CR 22	DIODE 1N759A	81483	1N759A	72 01 73
CR 25	DIODE IN1203A-IN3619		1N1203A	72 01 33
CR 26	DIODE 1N5401	*	1N5401	71 04 54
CR 28	DIODE 1N4004	21845	1N4004	71 03 84
CR 29	DIODE 1N4004	21845	1N4004	71 03 84
CR 30	DIODE 1N4004	21845	1N4004	71 03 84
CR 31	DIODE 1N4004	21845	1N4004	71 03 84

E L E C T R I C A L P A R T S L I S T -- RS40-158

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
CR 36	DIODE 1N4004	21845	1N4004	71 03 84
CR 37	DIODE 1N4004	21845	1N4004	71 03 84
CR 38	DIODE 1N4747A	81483	1N4747A	72 04 19
CR 39	DIODE 1N4004	21845	1N4004	71 03 84
CR 40	DIODE 1N759A	81483	1N759A	72 01 73
CR 41	DIODE 1N4004	21845	1N4004	71 03 84
CR 42	DIODE 1N4004	21845	1N4004	71 03 84
CR 45	DIODE 1N4384	14936	G100G110	72 03 84
CR 46	DIODE 1N4384	14936	G100G110	72 03 84
DS 1	PILOT LIGHT	91802	1040032	77 00 20
DS 2	LIGHT IND	91802	2190A87	77 00 23
F 1	FUSE 15AMP MDA 250V	75915	MDA	87 02 12
L 1	CHOKE ASSY	31411	DRWG	50 31 05
L 2	CHOKE ASSY	31411	DRWG	50 31 05
M 1	METER 0-15A-EXT-MS2T	33005	MS2T	75 00 65
M 2	METER 0-40V-MS2T	33005	MS2T	75 20 55
P 1	LINE CORD 16-3	70903	16-3	92 09 90
Q 1	TRANS 2N2714	03508	2N2714	70 01 80
Q 2	TRANS 2N2905A	04713	2N2905	70 50 67
Q 3	TRANS 2N2905A	04713	2N2905	70 50 67
Q 4	TRANS 2N2905A	04713	2N2905	70 50 67
Q 5	TRANS 2N2905A	04713	2N2905	70 50 67
Q 6	TRANS 2N2905A	04713	2N2905	70 50 67
Q 7	TRANS 2N2905A	04713	2N2905	70 50 67

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
Q 8	TRANS 2N2714	03508	2N2714	70 01 80
Q 9	TRANS 2N2714	03508	2N2714	70 01 80
Q 10	TRANS 2N2714	03508	2N2714	70 01 80
Q 11	TRANS 2N2714	03508	2N2714	70 01 80
Q 12	DIODE 1N5401	03508	UJ25	72 01 45
Q 13	TRANS 2N6258&SPEC	30045	DRWG	70 00 88
Q 14	TRANS 2N6258&SPEC	30045	DRWG	70 00 88
Q 15	TRANS 2N6258&SPEC	30045	DRWG	70 00 88
Q 16	TRANS 2N6258&SPEC	30045	DRWG	70 00 88
Q 17	TRANS 2N3447 & SPEC	21845	SPEC CONT DWG	70 50 71
Q 18	TRANS 2N2219A & SPEC	05828	2N2219A	70 50 68
Q 19	TRANS 2N2219A & SPEC	05828	2N2219A	70 50 68
Q 20	TRANS 2N2905A	04713	2N2905	70 50 67
Q 24	TRANS 2N3566	30045	2N3566	70 01 82
Q 25	TRANS 2N2905A	04713	2N2905	70 50 67
Q 26	TRANS 2N3566	30045	2N3566	70 01 82
Q 27	TRANS 2N3566	30045	2N3566	70 01 82
R 1	RWW 100-5W-5%		VALS	64 03 50
R 2	RMF 10K-.5W-2%	12400	RG20	62 06 10
R 3	RMF 274-.5W-1%	12126	M1/2T1	62 00 95
R 4	RCOMP 47K-.5W-10%	01121	RCR20	61 03 40
R 5	RMF 1.18K-.5W-1%	12126	M1/2TI	62 03 20
R 6	POT 200-.5W-20%	32997	3389P1201	60 01 15
R 7	RMF 442-.5W-1%	12126	M1/2T1	62 01 55

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
R 8	RMF 374-.5W-1%	12126	M1/2T1	62 01 35
R 9	RMF 442-.5W-1%	12126	M1/2T1	62 01 55
R 10	RMF 604-.5W-1%	12126	M1/2TI	62 02 10
R 11	POT 2K-.5W-20%	32997	3389P1202	60 02 07
R 12	POT 200-2W-10TURN	32997	3540-S-1-201	60 00 88
R 14	RWWS 0.07-25W		FR25	65 00 25
R 15	RMF 511-.5W-1%	12126	M1/2TI	62 01 80
R 16	RMF 750-.5W-1%	12126	M1/2TI	62 02 50
R 17	RCOMP 27K-.5W-10%	01121	RC20	61 03 20
R 18	RMF 1K-.5W-1%	12126	M1/2T1	62 03 00
R 19	RCOMP 100-.5W-10%	01121	RG20	61 00 70
R 20	RCOMP 1K-.5W-10%	01121	RC20	61 01 80
R 21	RCOMP 100K-.5W-10%	01121	RCR20	61 03 50
R 22	RCOMP 100-.5W-10%	01121	RG20	61 00 70
R 23	RMF 511-.5W-1%	12126	M1/2TI	62 01 80
R 24	RMF 1.5K-.5W-1%	12126	M5T1	62 03 60
R 25	RMF 1.24K-.5W-1%	12126	M1/2T1	62 03 40
R 26	RMF 750-.5W-1%	12126	M1/2TI	62 02 50
R 27	RMF 750-.5W-1%	12126	M1/2TI	62 02 50
R 28	RCOMP 100-.5W-10%	01121	RG20	61 00 70
R 29	RMF 3.01K-.5W-1%	12126	M1/2T1	62 04 80
R 30	RMF 3.01K-.5W-1%	12126	M1/2T1	62 04 80
R 31	RMF 681-.5W-1%	12126	M1/2T1	62 02 20
R 32	RMF 287-.5W-1%	12126	M1/2T1	62 01 01

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
R 33	RLTC 85-3W-3%	83125	1500S	63 02 40
R 34	RWW 680-2W-10%	12400	BWH	64 04 90
R 35	RCOMP 100-.5W-10%	01121	RG 20	61 00 70
R 37	RCOMP 100-.5W-10%	01121	RG 20	61 00 70
R 39	RWWS 500-25W		FR 25	65 06 60
R 41	RMF 52.3K-.5W-1%	12126	M1/2T1	62 07 28
R 42	RCOMP 15K-.5W-10%	01121	RCR20	61 03 00
R 46	RMF 3.48K-.5W-1%	12126	M1/2T1	62 04 89
R 47	RMF 1K-.5W-1%	12126	M1/2T1	62 03 00
R 54	RCOMP 47-.5W-10%	01121	RCR20	61 00 30
R 55	RLTC 0.2-5W-3%	83125	1500S	63 00 22
R 58	RLTC 0.2-5W-3%	83125	1500S	63 00 22
R 60	RCOMP 330-.5W-10%	01121	RC 20	61 01 20
R 61	RCOMP 1K-.5W-10%	01121	RC 20	61 01 80
R 62	RCOMP 1K-.5W-10%	01121	RC 20	61 01 80
R 63	POT 100-.5W-20%	32997	3389P 1 101	60 00 46
R 64	SHUNT 15AMP	09206	DRWG	06 87 61
R 66	POT 5K-2W-1OTURN	32997	3540-S-1-502	60 03 17
R 67	POT 200-.5W-20%	32997	3389P1201	60 01 15
R 69	RLTC 0.2-5W-3%	83125	1500S	63 00 22
R 70	RLTC 0.2-5W-3%	83125	1500S	63 00 22
R 71	RCOMP 820-.5W-10%	01121	RC 20	61 01 70
R 77	RCOMP 150-.5W-10%	01121	RCR20	61 00 80
R 78	RWW 800-5W-5%	12697	VC 5E	64 04 96

E L E C T R I C A L P A R T S L I S T -- RS40-158

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
R 79	RCOMP 220-.5W-10%	01121	RC20	61 01 00
R 93	RCOMP 47-.5W-10%	01121	RCR20	61 00 30
R 94	RCOMP 10K-.5W-10%	01121	RC20	61 02 90
R 95	RMF 36.5K-.5W-1%	12126	M1/2T1	62 06 87
R 96	RMF 36.5K-.5W-1%	12126	M1/2T1	62 06 87
R 97	RCOMP 1.5K-.5W-10%	01121	RC20	61 01 95
R 98	RMF 2.67K-.5W-1%	12126	M1/2T1	62 04 63
R 99	RMF 36.5K-.5W-1%	12126	M1/2T1	62 06 87
R 100	RMF 1.5K-.5W-1%	12126	M5T1	62 03 60
R 101	RMF 45.6K-.5W-1%	12126	M1/2TI	62 07 04
R 104	RMF 36.5K-.5W-1%	12126	M1/2T1	62 06 87
R 110	RCOMP 4.7K-.5W-10%	01121	RC20	61 02 50
R 111	RCOMP 47K-.5W-10%	01121	RCR20	61 03 40
R 112	RCOMP 100-.5W-10%	01121	RG20	61 00 70
R 113	RCOMP 820-.5W-10%	01121	RC20	61 01 70
R 114	RCOMP 1K-.5W-10%	01121	RC20	61 01 80
R 115	RCOMP 1K-.5W-10%	01121	RC20	61 01 80
R 116	RCOMP 100-.5W-10%	01121	RG20	61 00 70
R 119	RCOMP 100K-.5W-10%	01121	RCR20	61 03 50
R 123	RCOMP 22K-.5W-10%	*	RC20	61 03 10
R 124	RCOMP 220-.5W-10%	01121	RC20	61 01 00
R 125	RCOMP 220-.5W-10%	01121	RC20	61 01 00
R 126	RCOMP 2.2K-.5W-10%	01121	RG20	61 00 03
S 1	SWITCH	73559	26K50-73XG1B2	88 00 30

ELECTRICAL PARTS LIST -- RS40-158

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
T 1	XFORMER	09206	DRWG	505520
TB 1	TERM STRIP	71785	3-170	850033
TB 2	BARRIER STRIP 670A-Y-5	75382	670-AY5	851105
TB 3	BARRIER STRIP 671-4	75382	671-4	851204
TB 4	TERM STRIP	71785	3-170	850033

* ANY GOOD COMMERCIAL GRADE ELECTRICAL EQUIVALENT WHICH IS READILY AVAILABLE MAY BE USED.

E L E C T R I C A L P A R T S L I S T -- RS40-158OV

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
C 114	CAP .15MF-250V		MKT1813	800210
CR134	SCR MCR 649AP-3	04713	MCR649AP3	720290
CR135	DIODE 1N 4004	21845	1N4004	710384
CR137	DIODE 60HF 60	81483	60HF60	720488
CR138	DIODE 1N 4004	21845	1N4004	710384
CR139	DIODE 1N 4004	21845	1N4004	710384
F 2	FUSE 20A-250V	71400	MDA	870222
Q 121	TRANS 2N 2905A	04713	2N2905	705067
Q 122	TRANS 2N 2219A & SPEC	05828	2N2219A	705068
R 181	RMF 12.4K-.5W-1%	12126	M1 1/2 T1	620617
R 182	RLTC 700-3W-3%	83125	1300S	630370
R 183	RCOMP 1.5K-.5W-10%	01121	RC20	610195
R 184	RCOMP 1.5K-.5W-10%	01121	RC20	610195
R 187	RCOMP 1K-.5W-10%	01121	RC20	610180

* ANY GOOD COMMERCIAL GRADE ELECTRICAL EQUIVALENT WHICH IS READILY AVAILABLE MAY BE USED.

ELECTRICAL PARTS LIST -- RS40-1580VX

REFERENCE	COMPONENT	MFR	MFR PART NUMBER	STOCK #
CR 15	DIODE 1N2167	04713	1N2167	720139
Q 10	TRANS TR1000	94144	2N2223	700071
R 3	RLTC 250-3W-3%	83125	1300S	630280
R 5	RLTC 1.18K-3W-3%	07088	KM300	630400
R 24	RLTC 1.5K-3W-3%	83125	1300S	630420
R 26	RLTC 750-3W-3%	83125	1300S	630375
R 27	RLTC 750-3W-3%	83125	1300S	630375
R 29	RLTC 3K-3W-3%	83025	1300S	630460
R 30	RLTC 3K-3W-3%	83025	1300S	630460
R 31	RLTC 625-3W-3%	07088	KM300	630360
R 32	RLTC 200-3W-3%	15915	TS3W	630270

* ANY GOOD COMMERCIAL GRADE ELECTRICAL EQUIVALENT WHICH IS READILY AVAILABLE MAY BE USED.

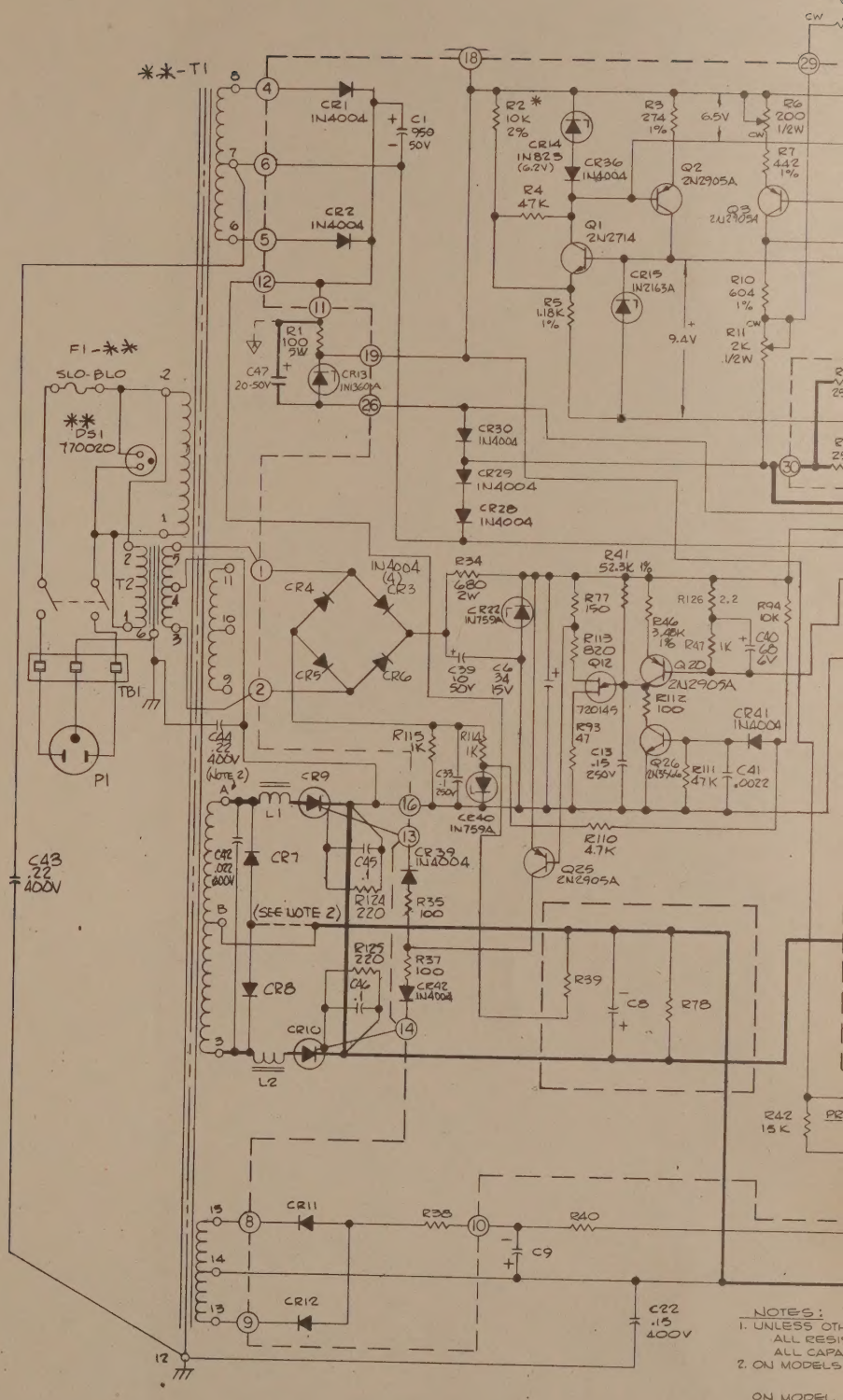
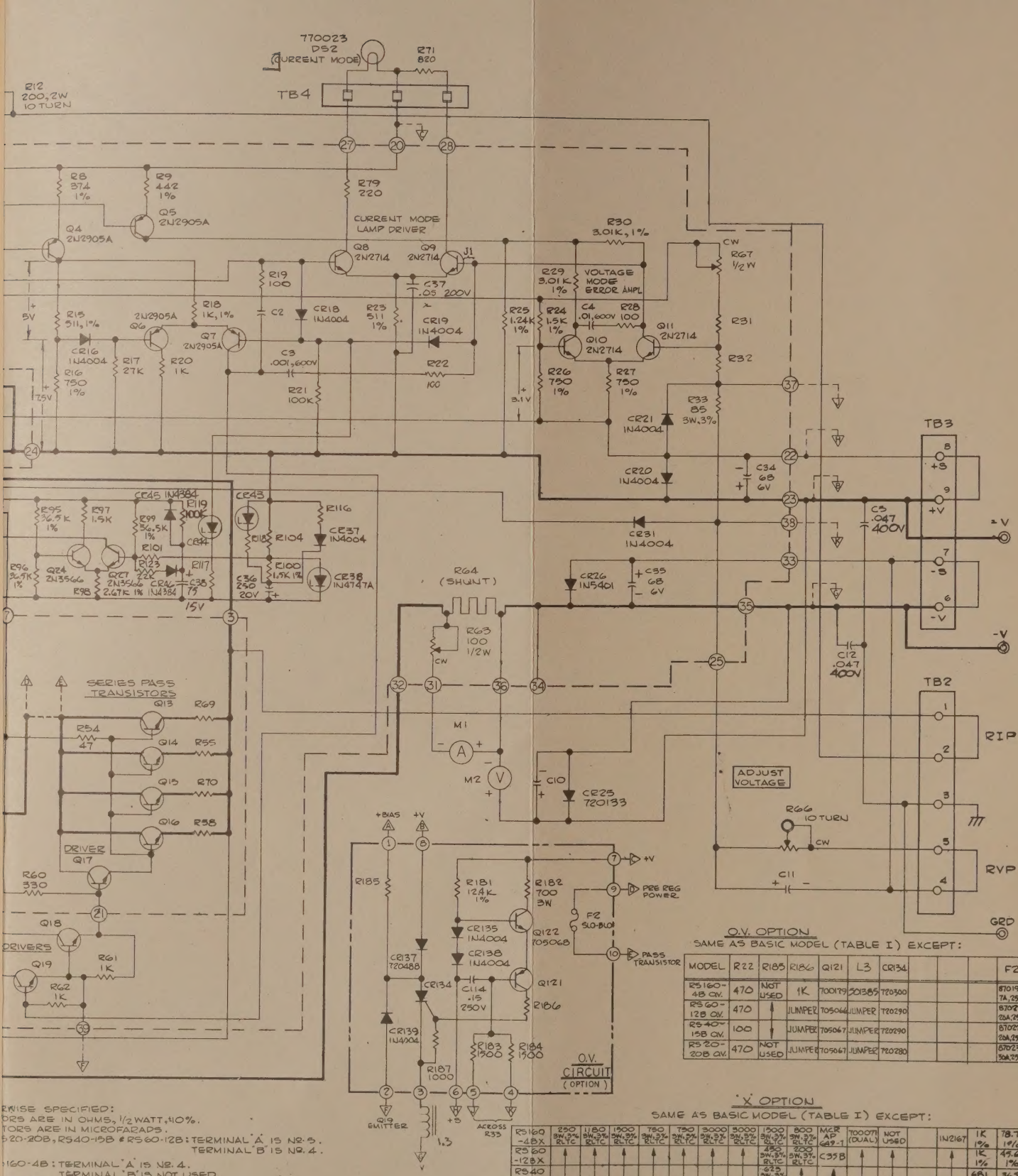


TABLE I

MODEL	T1	L1	L2	M1	M2	C2	C8	C9	C10	C11	CR7	CR8	CR9	CR10	CR11	CR12	F1	R114	R117	R118	CR43	CE44	Q13-Q16	Q17	Q18	Q19
RS 160-4B	509750	509720	509142	0-5A	0-160V	.01, 600V	6000 200V	160, 250V	1,800 200V	0.47, 200V	IN 3619	IN 3613	MCR 646-7	MCR 646-7	IN 4585	IN 4585	15A	3.3K	680K	33K	IN 4747A	IN 4747A	700429	700429	700205	700
RS 60-12B	509730	509110	509110	0-15A	0-60V	.0033 600V	23,400 75V	NOT USED	4,500 75V	8, 100V	NOT USED	NOT USED	C35B	C35B	NOT USED	NOT USED	20A	100	NOT USED	10K	IN 4747A	NOT USED	700085	705070	705075	705
RS 40-15B	509752	509105	509105	0-15A	0-40V	.0033 600V	54,800 50V	NOT USED	9,300 50V	10, 50V	NOT USED	NOT USED	C35B	C35B	NOT USED	NOT USED	15A	100	NOT USED	NOT USED	NOT USED	NOT USED	700402	705071	705068	705
RS 20-20B	509540	509100	509100	0-20A	0-20V	.0033 600V	84,000 40V	NOT USED	12,400 40V	10, 50V	NOT USED	NOT USED	C22BF	C22BF	NOT USED	NOT USED	15A	100	NOT USED	NOT USED	NOT USED	NOT USED	700402	705071	705068	705



O.V. OPTION

SAME AS BASIC MODEL (TABLE I) EXCEPT:

MODEL	R22	R185	R186	Q121	L3	CR134				FZ
RS160-48 OV.	470	NOT USED	1K	T00179	501385	T20300				870194 7A, 250V
RS60-128 OV.	470	↑	JUMPER	T05066	JUMPER	T20290				870222 20A, 250V
RS40-158 OV.	100	↑	JUMPER	T05067	JUMPER	T20290				870222 20A, 250V
RS20-208 OV.	470	NOT USED	JUMPER	T05067	JUMPER	T20280				870232 30A, 250V

'X' OPTION

SAME AS BASIC MODEL (TABLE I) EXCEPT:

MODEL	R3	R5	R24	R26	R27	R29	R30	R31	R32	CR9-CR10	Q10	Q11		CR15	R101	R104
RS160-48X	250 5W, 5% RLTC	1180 5W, 5% RLTC	1500 5W, 5% RLTC	750 5W, 5% RLTC	750 5W, 5% RLTC	3000 5W, 5% RLTC	3000 5W, 5% RLTC	1500 5W, 5% RLTC	800 5W, 5% RLTC	MCR AP 649-1	T00071 (DUAL)	NOT USED		1N2167	1K 1%	78.7K 1%
RS60-128X	↑	↑	↑	↑	↑	↑	↑	450 5W, 5% RLTC	220 5W, 5% RLTC	C35B	↑	↑		↑	1K 1%	45.6K 1%
RS40-158X	↑	↑	↑	↑	↑	↑	↑	625 5W, 5% RLTC	↓	↓	↑	↑		↑	681 1%	34.5K 1%
RS20-208X	↑	↑	↑	↑	↑	↑	↑	500 5W, 5% RLTC	↓	↓	↑	↑		↑	45.2K 1%	21.0K 1%

RWISE SPECIFIED:
DRS ARE IN OHMS, 1/2 WATT, ±10%.
TORS ARE IN MICROFARADS.
S 20-208, RS40-158 & RS60-128: TERMINAL 'A' IS NO. 5.
TERMINAL 'B' IS NO. 4.
160-48: TERMINAL 'A' IS NO. 4.
TERMINAL 'B' IS NOT USED.
SELECT AT TEST = NOMINAL 10K.

FOR TI-EUROPEAN, F1 & DS1

0.25, 25W	S04216 -A		1740, 1%	NOT USED	5K, 50W		0.5, 3W	5A, SHUNT	50K 2W	500	1K, 50W	NOT USED			100K 1%	523K 1%	10, 3W, 3%	806 1%
0.10, 25W	NOT USED		422, 1%	1K, 25W	NOT USED	T70021	0.2, 3W	15A, SHUNT	5K, 2W	200	2K, 5W	NOT USED	S04223	10A S14-B	45.6K 1%	45.6K 1%	NOT USED	150 1%
0.07, 25W	NOT USED		681, 1%	500, 25W	NOT USED	T70021	0.2, 3W	15A, SHUNT	5K, 2W	200	800, 5W	NOT USED	S04208	8A S14-B	45.6K 1%	36.5K 1%	NOT USED	287 1%
0.10, 25W	NOT USED		523, 1%	500, 25W	NOT USED		0.1, 5W	20A, SHUNT	2K, 2W	200	300, 5W	25W			536K 1%	13.0K 1%	NOT USED	200 1%
R14	T2		R31	R39	R40	DS1	R53, 58, 68, 70	R64	R66	R67	R78	R92	T1-E	F1	R101	R104	R38	R32

MODEL RS ('B' SERIES)				
SCHEMATIC DIAGRAM				
SIZE	CODE IDENT NO.	12142		K
E	09206			
SCALE		SHEET		

REMIT TO
ON – DONNER CORPORATION
37388
FICE BOX
RINCON ANNEX
FRANCISCO, CALIFORNIA 94137

PACKING LIST

PREPARATION FOR DELIVERY
COMMERCIAL XX OTHER

INVOICE NUMBER
INVOICE DATE
DATE SHIPPED
SHIPPED VIA
B/L NUMBER
MEMO NUMBER

e
STOMER NO.
65503-1
30
SHIP PT. 1
TAXABLE YES NO XX
CERTIFICATION REQUIRED
None

	SCHEDULED DELIVERY	QUANTITY ORDERED		QUANTITY SHIPPED	TOTAL
	8/19/76	1			
		1			

115 VAC XX | 230 VAC | PAGE 1 | OF 1

CATE OF CONFORMANCE

URNISHED ARE IN ACCORDANCE WITH THE AP-
EMENTS, RECORDS OF MANUFACTURING, INSPEC-
IAL CERTIFICATIONS (CHEMICAL AND OR PHY-
CERTIFICATIONS) ARE MAINTAINED ON FILE.

SYSTRON DONNER CORPORATION

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